Adaptations

\*Organisms may be classified based on their unique characteristics.

*Animals have several characteristics that set them apart from other living things. Animals are* [*eukaryotic*](http://en.wikipedia.org/wiki/Eukaryote) *and mostly* [*multicellular*](http://en.wikipedia.org/wiki/Multicellular)*, which separates them from* [*bacteria*](http://en.wikipedia.org/wiki/Bacteria) *and most* [*protists*](http://en.wikipedia.org/wiki/Protist)*. They are* [*heterotrophic*](http://en.wikipedia.org/wiki/Heterotroph)*, generally digesting food in an internal chamber, which separates them from* [*plants*](http://en.wikipedia.org/wiki/Plant) *and* [*algae*](http://en.wikipedia.org/wiki/Alga)*. They are also distinguished from plants, algae, and* [*fungi*](http://en.wikipedia.org/wiki/Fungus) *by lacking rigid* [*cell walls*](http://en.wikipedia.org/wiki/Cell_wall)*. All animals are* [*motile*](http://en.wikipedia.org/wiki/Motility)*, if only at certain life stages. In most animals,* [*embryos*](http://en.wikipedia.org/wiki/Embryo) *pass through a* [*blastula stage*](http://en.wikipedia.org/wiki/Blastula)*,] which is a characteristic exclusive to animals.*

[*http://plantphys.info/organismal/lechtml/taxonomy.shtml#bioclass*](http://plantphys.info/organismal/lechtml/taxonomy.shtml#bioclass)

Kingdom, Phylum, Class, Order, Family, Genus, Species

(King, Phillip, Came, Over, For, Good, Soup) or (Kids, Prefer Candy, Over, Fancy, Green, Salads)

\*Many of these characteristics are the result of adaptations that occur in order to ensure survival.

*All animals live in habitats. Habitats provide food, water, and shelter which animals need to survive, but there is more to survival than just the habitat. Animals also depend on their physical features to help them obtain food, keep safe, build homes, withstand weather, and attract mates. These physical features are called called physical adaptations. Physical adaptations do not develop during an animal's life but over many generations. The shape of a bird's beak, the number of fingers, color of the fur, the thickness or thinness of the fur, the shape of the nose or ears are all examples of physical adaptations which help different animals to survive.*

Look at the Peppered Moth, animals in the snow, animals that camouflage themselves, animals that can use mimicry to help them escape predators.

\*Adaptations may be divided into three categories, structural, physiological, and behavioral.

*Structural adaptations are physical features of an organism like the bill on a bird or the fur on a bear.*

[*http://www.nhptv.org/natureworks/nwep1.htm*](http://www.nhptv.org/natureworks/nwep1.htm)

*A* [*metabolic*](http://www.biology-online.org/dictionary/Metabolic) *or physiologic* [*adjustment*](http://www.biology-online.org/dictionary/Adjustment) *within the* [*cell*](http://www.biology-online.org/dictionary/Cell)*, or* [*tissues*](http://www.biology-online.org/dictionary/Tissues)*, of an* [*organism*](http://www.biology-online.org/dictionary/Organism) *in response to an environmental* [*stimulus*](http://www.biology-online.org/dictionary/Stimulus) *resulting in the improved ability of that* [*organism*](http://www.biology-online.org/dictionary/Organism) *to cope with its changing* [*environment*](http://www.biology-online.org/dictionary/Environment)*.*

[*http://kingfish.coastal.edu/biology/sgilman/778AnimalAdapt.htm*](http://kingfish.coastal.edu/biology/sgilman/778AnimalAdapt.htm)

[*http://enhg.4t.com/b/b11/11\_24.htm*](http://enhg.4t.com/b/b11/11_24.htm)

*Behavioral adaptations are the things organisms do to survive. For example, birdcalls and migration are behavioral adaptations*.

<http://www.historyking.com/evolution/adaption/Examples-Of-Behavioural-Adaptation-Of-Animals.html>

Example: Dogs- they went from being wild animals that hunted for their food. Now they are domesticated animals that depend on humans for their food.

\*Organisms depend on their physical features to help them obtain food, keep safe, build homes, withstand weather, attract mates, and reproduce. These physical features are called structural adaptations. Structural adaptation happens over a long period of time in the form of changing genetic traits when the better suited form of an organism reproduce more successfully in a process called natural selection.

The animals that able to survive are the ones that reproduce. So, those animals genes re passed on and the weaker animals or less adaptable animals do not pass along their genes.

*Natural Selection is a* [*process*](http://www.biology-online.org/dictionary/Process) *in* [*nature*](http://www.biology-online.org/dictionary/Nature) *in which* [*organisms*](http://www.biology-online.org/dictionary/Organisms) *possessing certain genotypic characteristics that make them better adjusted to an* [*environment*](http://www.biology-online.org/dictionary/Environment) *tend to survive, reproduce, increase in number or* [*frequency*](http://www.biology-online.org/dictionary/Frequency)*, and therefore, are able to* [*transmit*](http://www.biology-online.org/dictionary/Transmit) *and perpetuate their essential genotypic qualities to succeeding* [*generations*](http://www.biology-online.org/dictionary/Generation)*.*

\*The shape of a bird's beak, the number of fingers, the size of a plant’s leaves, or the thickness or thinness of a plant’s stem, are all structural adaptations that occur as a result of natural selection.

<http://en.wikipedia.org/wiki/Survival_of_the_fittest>

In some cases, the inability of organisms to adapt quickly enough have led to their extinction or endangerment.

<http://www.tropical-rainforest-animals.com/Animal-Extinction.html>

Behavioral adaptations involve the different ways in which an animal reacts to its environment. Nocturnal animals which are active at night, arboreal animals which make their homes in trees, and fossorial, or burrowing animals, are all examples of behavioral adaptations.

Opening and closing of stomata in plants due to availability of water are also behavioral adaptations.

Physiological adaptations permit an organism to perform special functions like regulating temperature or phototropism and other homeostatic functions. Unlike natural selection that requires generations to occur, physiological adaptation is generally narrow in scope and involves response of an organism to a specific stimulus like tanning of skin when exposed to the sun.

The fossil record can trace the changes and adaptations that organisms have made throughout Earth’s history. Emphasis is placed on the effects of individual variation on survival within one species in a changing environment.

Scientist look through fossil records and date them. By looking at fossils according to their age, you can see a timeline of evolution. The biggest problem with this is the few numbers of fossils.

Connections

Adaptation enables organisms to survive in their environment.

That’s why you cant take an animal out of their native environment and expect them to survive. That’s also why when you go to a zoo in a hot climate, you have to an arctic zone, rainforest zone, etc. Otherwise you could only have a Zoo with native species.

Natural selection is a process by which organisms with genetic traits more well-suited for an environment reproduce, while those with traits not well suited may become extinct or endangered.

Passing of genetic material from parent to offspring is examined in detail in a previous unit on genetics. The environment also plays a large role in adaptive processes. Interactions of organisms within an ecosystem determine which species will be successful and which will not; these interactions are studied in an upcoming unit on ecology.

Enduring Understandings

1. Traits essential for survival may be inherited through genetic material or

acquired as a result of environmental factors.

1. Organisms can be classified based on these traits using a dichotomous key.

<http://year2550.weebly.com/dichotomous-key.html>

3. Charles Darwin first proposed the theory of natural selection based on his

observations of nature.

<http://www.globalchange.umich.edu/globalchange1/current/lectures/selection/selection.html>

4. Natural selection is a process by which organisms with traits most well-suited

for survival live to reproduce and therefore pass on beneficial traits to their

offspring. Organisms with traits detrimental to survival do not survive to

reproduce, thereby reducing gene frequency for non- beneficial traits.

5. Analogous traits correspond in function, but are not evolved from

corresponding organs (e.g., the wing of a bee and the wing of a hummingbird).

<http://dennis-holley.suite101.com/the-evidence-of-evolution-a124573>

6. Homologous traits are evolved from the same organs, but over time, the

function has changed (e.g., the wing of a bird and the foreleg of a horse are

homologous).

<http://www.nku.edu/~whitsonma/Bio120LSite/Bio120LReviews/Bio120LHomologyRev.html>

7. Structural adaptations are physical characteristics that help ensure an animal’s

survival, and occur as a result of natural selection over many generations.

8. Behavioral adaptations include an organism’s responses to its environment,

and may be genetically inherited or acquired as a result of environmental

factors.

\*Remember the conversation of the Belton to New York city transfer & vice versa

9. Physiological adaptations generally occur within short time frames as an

organism responds to specific environmental factors in an effort to maintain

homeostasis.

\*Working out for a sport

10. Earth’s fossil record can be traced back to one-celled organisms that existed

during Precambrian Time more than 500 million years ago, moving forward to

modern plants and animals in the current era.

\*Sea creatures in the TX bedrock

11. Relationships between organisms over time may be graphically represented

with a phylogenetic tree.

\* Man not from Monkey (Man & Monkey From common ancestor)

12. The adaptive history of life on Earth can be tied to specific eras and periods of

geologic time.

\*We can see this through fossil records)

13. Changes in the physical conditions of an ecosystem (abiotic

factors) affect the survival of organisms and can result in adaptive changes.

Essential Questions

1. How are animals classified? K,P,C,O,F,G,S

2. Who was Charles Darwin and what were his contributions to the theory of natural

selection? Came up with the Theory of Evolution

1. What is natural selection and how is it related to adaptation and survival? The

organisms / species that are best suited to survive are able to pass along their

genes.

4. What are some examples of adaptive traits found in modern plants and animals?

For example, in hummingbirds, a long [bill](http://www.biology-online.org/bodict/index.php?title=Bill&action=edit) can be an adaptive trait since it is both heritable and adaptive. And for over a long time, more and more hummingbirds possess a long bill since it maximizes the reproductive success of these [birds](http://www.biology-online.org/dictionary/Bird).

5. What is the difference between structural, behavioral, and physiological

adaptations?

\*See above and below or Adapt PP on Wiki

6. What geological evidence is there that modern organisms are related to organisms

found in the fossil record?

http://en.wikipedia.org/wiki/Evidence\_of\_common\_descent

7. How can traits be compared?

By their function / purpose

8. How can changing the physical environment affect the survival of organisms?

They are forced to adapt or die

9. How can changes in the physical environment affect adaptive processes of

organisms?

Again, it causes a forced adaptation for survival

Essential Concepts and Skills

By the end of the unit the student is expected to:

1. compare and contrast inherited and acquired traits

2. classify animals using a dichotomous key

3. describe the theory of natural selection and its relationship to gene frequency

4. explain that adaptations occur as responses to stimuli in the environment

5. identify Charles Darwin and give examples on which he based his theory of natural

selection

6. compare and contrast analogous and homologous structures

7. create a phylogenetic tree showing the relationships of organisms over time

8. design an animal with structural adaptations that will enhance its chance for

survival

9. compose a story describing the behavioral adaptations an organism exhibits in

response to stimuli in its environment

10. deduce which physiological adaptations might occur based on given

environmental conditions

11. justify why specific physiological adaptations help maintain homeostasis

12. analyze environments to determine which adaptations would be most beneficial

13. create a timeline showing the history of life on Earth and how it relates to specific

eras and periods of geologic time

14. predict whether or not an organism will survival abiotic changes in its

environment

What do students typically have as misconceptions?

(What do students believe (sometimes) but are not true)

1. Students believe that transmitted characteristics are acquired during the life time

of the animal.

2. Acquired characteristics can be inherited.

3. Adaptation is something an organism chooses.

4. Evolution is goal-directed.

5. Evolutionary changes are driven by need.

Preconception Survey

1. What special physical adaptations do birds have? ( Beaks ) one example

2. What behavior adaptations do birds have? ( Migration ) “ “

3. Why are they important? ( Survival )

4. How did these adaptations occur? ( Evolution, Natural Selection )

TEKS Covered

**7.11 Organisms and environments.** The student knows that populations and species demonstrate variation and inherit many of their unique traits through gradual processes over many generations. The student is expected to:

A) examine organisms or their structures such as insects or leaves and use dichotomous keys for identification.

B) explain variation within a population or species by comparing external features, behaviors, or physiology of organisms that enhance their survival such as migration, hibernation, or storage of food in a bulb.

C) identify some changes in genetic traits that have occurred over several generations through natural selection and selective breeding such as the Galapagos Medium Ground Finch (*Geospiza fortis*) or domestic animals.

***Supporting Standard-Category 4***

**7.12 Organisms and environments.** The student knows that living systems at all levels of organization demonstrate the complementary nature of structure and function. The student is expected to:

A) investigate and explain how internal structures of organisms have adaptations that allow specific functions such as gills in fish, hollow bones in birds, or xylem in plants.

College Board Standards Covered

LSM-PE.1.1.1 Construct a representation that reflects the appropriate time scale of Earth’s history and includes the variation of organisms over time. Representation describes major evolutionary developments (e.g., the first organism, oxygen in the atmosphere, the first land plants, appearance of vertebrates, etc.).

LSM-PE.1.1.2 Construct a representation, using information from the fossil record, that describes the organisms present during several different time periods in Earth’s history.

LSM-PE.1.1.3 Observe the anatomical structures of a variety of organisms, and describe the similarities and differences among them. Organize the organisms into groups based on their similarities and differences. Make a claim about how recently organisms among the groups

7.11 Organisms and environments. The student knows that populations and species

demonstrate variation and inherit many of their unique traits through gradual processes over

many generations. The student is expected to:

A) examineorganismsortheirstructuressuchasinsectsorleavesandusedichotomous

keys for identification.

B) explainvariationwithinapopulationorspeciesbycomparingexternalfeatures,

behaviors, or physiology of organisms that enhance their survival such as migration,

hibernation, or storage of food in a bulb.

C) identify some changes in genetic traits that have occurred over several generations

through natural selection and selective breeding such as the Galapagos Medium Ground

Finch (*Geospiza fortis*) or domestic animals. *Supporting Standard-Category 4*

7.12 Organisms and environments. The student knows that living systems at all levels of

organization demonstrate the complementary nature of structure and function. The student is

expected to:

A) investigateandexplainhowinternalstructuresoforganismshaveadaptationsthatallow

specific functions such as gills in fish, hollow bones in birds, or xylem in plants. shared a common ancestor, and justify that claim based on the degree of similarity of their characteristics.

LSM-PE.1.2.2 Give examples, using information gathered from print and electronic resources, of natural environmental changes that have occurred in the recent past. Collect and organize data about the number, kind and/or geographical distribution of organisms before and after these changes occurred. Make a claim about how these environmental changes have affected the number, kind and/or distribution of specific organisms living in these environments. Using these examples of environmental changes and the data on number, kind and/or geographical distribution of organisms, make and justify a claim about the effects of changes in environmental conditions on the survival of some organisms compared to the effects of these changes on the survival of other organisms.

*[BOUNDARY: The focus is on the effects of changes in the environment on the survival of organisms. The examples should not only describe the effects on the survival rates of various species but also describe the effects of individual variation on survival within one species.]*

LSM-PE.1.2.3 Give examples, using information gathered from print and electronic resources, of environmental changes that have occurred in the recent past as a result of human actions. Collect and organize data about the number, kind and/or geographical distribution of organisms before and after these changes occurred. Make a claim about how these environmental changes have affected the number, kind and/or distribution of specific organisms living in these environments. Using these examples of environmental changes and the data on number, kind and/or geographical distribution of organisms, make and justify a claim about the effects of changes in environmental conditions on the survival of some organisms compared to the effects of these changes on the survival of other organisms.

LSM-PE.1.2.4 Give examples, using information gathered from print and electronic resources, of observations made by Charles Darwin of variation within species and of changes in environmental conditions that he used in the development of his theory of natural selection. For each example, describe the relationship between the variation within species and the changes in the environmental conditions.

LSM-PE.3.1.3 Give examples of physical (abiotic) conditions that affect the survival of specific kinds or groups of organisms (e.g., fish that live in salt water versus those that live in fresh water; algae that can survive only within a certain range of light; fungi and plants that require a certain amount of water to survive). Use these examples to make and justify a claim about the effect of physical (abiotic) conditions on a specific organism’s survival.

LSM-PE.3.1.4 Use data as evidence to make and justify a claim concerning whether or not a population of organisms is affected by varying environmental conditions in an ecosystem. Data show information regarding the number of organisms of each species in an ecosystem under varying environmental conditions (e.g., what happens to the number of a particular species — including organisms that can survive significant changes and those that cannot — when temperature, soil, moisture or sunlight varies over time). Using these data, predict the survival of a particular species in a specific ecosystem when certain changes occur to the physical (abiotic) environment.

LSM-PE.1.1.4 Construct a simple model (e.g., phylogenetic tree), based on anatomical

similarities and differences, of the degree of relatedness of different species. If necessary,

revise the model based on new or additional anatomical evidence.LSM-PE.3.1.5 Make a general claim about the relationship between organisms’ traits and their chances of survival. Justification for the claim is based on data from several populations of organisms with varying traits and under a variety of environmental conditions.

*[BOUNDARY: The traits presented in the data table should be appropriate for students in grades 6–8 in that the students are able to identify the connection between each trait and the environmental factors.]*

Vocabulary

Natural selection- environment tend to survive and transmit their genetic characteristics in increasing numbers to succeeding generations while those less adapted tend to be eliminated.

Gene frequency- The frequency of occurrence of an allele in relation to that of other alleles of the same gene in a population.

Structural adaptations- The responsive adjustment of a sense organ, such as the eye, to varying conditions, such as light intensity

behavioral adaptations- Behavioral adaptations are the things organisms do to survive. For example, bird calls and migration are behavioral adaptations.

physiological adaptations- A metabolic or physiologic adjustment within the cell, or tissues, of an organism in response to an environmental stimulus resulting in the improved ability of that organism to cope with its changing environment.

For example, the adaptation of horses' teeth to the grinding of grass, or their ability to run fast and escape predators. The camels produce concentrated urine compared to other mammals as it has to reduce the water loss,this is a kind of physiological adaptation as the kidney of camels are designed in a such a way that the wastage of water is minimum.

Extinction- In [biology](http://www.newworldencyclopedia.org/entry/Biology) and [ecology](http://www.newworldencyclopedia.org/entry/Ecology), extinction is the ceasing of existence of a [species](http://www.newworldencyclopedia.org/entry/Species) or a higher [taxonomic](http://www.newworldencyclopedia.org/entry/Taxonomy) unit (*taxon*), such as a phylum or class. The moment of extinction is generally considered to be the death of the last individual of that species or group.

Endangerment- An endangered species is a population of organisms which is at risk of becoming [extinct](http://en.wikipedia.org/wiki/Extinct) because it is either few in numbers, or threatened by changing environmental or predation parameters

Inherited traits- http://www.ehow.com/about\_5393500\_inherited-traits.html

Dichotomous key- A reference tool where a series of choices between alternative characters leads progressively to the identification of the [species](http://www.biology-online.org/dictionary/Species).

acquired traits- acquired traits can not be passed on genetically. You can't inherit your uncle's knowledge, skills, ideas or memories and it doesnt' work that way with other organisms either. Acquired traits include things such as calluses on fingers, larger muscle size from exercise or from avoiding predators. Behaviors that help an organism survive would also be considered acquired characteristics most of the time. Things like where to hide, what animals to hide from and other behavior like that. For plants acquired characteristics might include bending because of wind or growths resulting from insect bites (such as galls)

http://utahscience.oremjr.alpine.k12.ut.us/Sciber01/7th/cells/html/inhvsacq.htm

biotic factors- Biotic, meaning of or related to life, are living factors. Plants, animals, fungi, protist and bacteria are all biotic or living factors

abiotic factors- Abiotic, meaning not alive, are nonliving factors that affect living organisms. Environmental factors such habitat (pond, lake, ocean, desert, mountain) or weather such as temperature, cloud cover, rain, snow, hurricanes, etc. are abiotic factors.

Stimuli- something that incites to action or exertion or quickens action, feeling, thought.

Homeostasis- The human body manages a multitude of highly complex interactions to maintain balance or return systems to functioning within a normal range. These interactions within the body facilitate compensatory changes supportive of physical and psychological functioning. This process is essential to the survival of the person and to our species. An inability to maintain homeostasis may lead to death or a disease, a condition known as *homeostatic imbalance*.

Evolution- A gradual process in which something changes into a different and usually more complex or better form.

Population- A population is all the organisms that both belong to the same species and live in the same geographical area.

species, - A species is often defined as a group of [organisms](http://en.wikipedia.org/wiki/Organisms) capable of interbreeding and producing fertile offspring

migration- The seasonal movement of a complete population of animals from one area to another. Migration is usually a response to changes in temperature, food supply, or the amount of daylight, and is often undertaken for the purpose of breeding. Mammals, insects, fish, and birds all migrate. The precise mechanism of navigation during migration is not fully understood, although for birds it is believed that sharp eyesight, sensibility to the Earth's magnetic field, and the positions of the Sun and other stars may play a role

hibernation- is a state of inactivity and [metabolic](http://en.wikipedia.org/wiki/Metabolism) depression in [animals](http://en.wikipedia.org/wiki/Animal), characterized by lower body temperature, slower breathing, and lower metabolic rate. Hibernating animals conserve food, especially during winter when food supplies are limited, tapping energy reserves, [body fat](http://en.wikipedia.org/wiki/Body_fat), at a slow rate. It is the animal's slowed metabolic rate which leads to a reduction in body temperature and not the other way around. Hibernation may last several days or weeks depending on species, ambient temperature, time of year, and fur on the animal's body

camouflage- is a method of [crypsis](http://en.wikipedia.org/wiki/Crypsis) (hiding). It allows an otherwise visible [organism](http://en.wikipedia.org/wiki/Organism) or object to remain unnoticed, by blending with its environment. Examples include a [tiger](http://en.wikipedia.org/wiki/Tiger)'s stripes, the [battledress](http://en.wikipedia.org/wiki/Battledress) of a modern [soldier](http://en.wikipedia.org/wiki/Soldier) and a [butterfly](http://en.wikipedia.org/wiki/Butterfly) camouflaging itself as a [leaf](http://en.wikipedia.org/wiki/Leaf).

mimicry - the similarity of one species to another which protects one or both. This similarity can be in [appearance](http://en.wikipedia.org/wiki/Appearance), [behaviour](http://en.wikipedia.org/wiki/Behaviour), [sound](http://en.wikipedia.org/wiki/Sound), [scent](http://en.wikipedia.org/wiki/Scent) and even [location](http://en.wikipedia.org/wiki/Location_(geography))

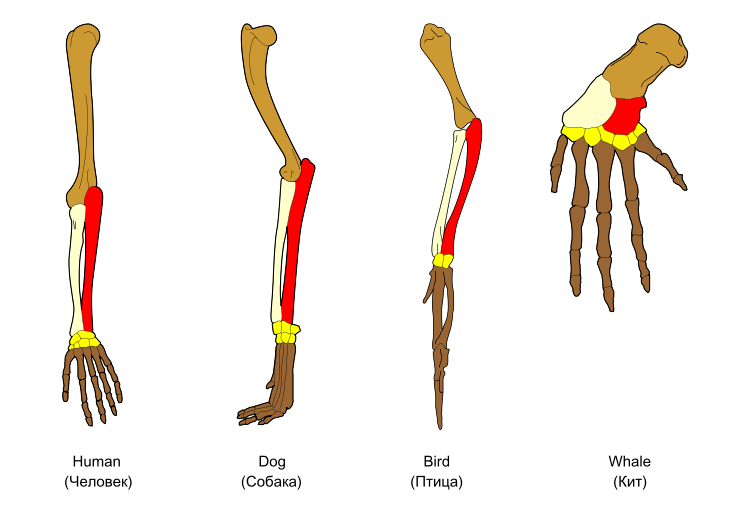
niche- is a term describing the relational position of a [species](http://en.wikipedia.org/wiki/Species) or [population](http://en.wikipedia.org/wiki/Population) in its [ecosystem](http://en.wikipedia.org/wiki/Ecosystem) to each other

selective breeding- the process of breeding [plants](http://en.wikipedia.org/wiki/Plant_breeding) and [animals](http://en.wikipedia.org/wiki/Animal_breeding) for particular genetic traits.

Ancestor- a parent or a [grandparent](http://en.wikipedia.org/wiki/Grandparent), [great-grandparent](http://en.wikipedia.org/wiki/Great-grandparent), great-great-grandparent, and so forth

analogous traits- corresponding in function, but not evolved from corresponding organs, as the wings of a bee and those of a hummingbird.

homologous traits- traits often have similar embryological origins and development



fossil record- The totality of fossilized artifacts and their placement within the earth's rock [strata](http://www.biology-online.org/dictionary/Strata). It provides information about the history of life on earth, for instance what the [organisms](http://www.biology-online.org/dictionary/Organism) look like, where and when they live, how they evolved, *etc*.

Fossil record can provide interesting information about the [evolution](http://www.biology-online.org/dictionary/Evolution) and the history of life on earth such as the way the particular species have lived during a specific geological period and then evolved in time.

phylogenetic tree- A phylogenetic tree or evolutionary tree is a branching diagram or "[tree](http://en.wikipedia.org/wiki/Tree_(graph_theory))" showing the inferred [evolutionary](http://en.wikipedia.org/wiki/Evolution) relationships among various biological [species](http://en.wikipedia.org/wiki/Species) or other entities based upon similarities and differences in their physical and/or genetic characteristics. The taxa joined together in the tree are implied to have descended from a [common ancestor](http://en.wikipedia.org/wiki/Common_descent). (evolutionary tree)

